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PROCEDURE FOR REPAIR OF DAMAGED HAWK TRAINING MISSILE WING MOUNTING HOLES

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1 December 1980

U.S. ARMY MISSILE COMMAND
Redstone Arsenal, Alabama 35898

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Repair
Replace
HAWK TRAINING MISSILE

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides detailed instructions for repair of damaged wing mounting holes on IMPROVED HAWK training missiles by installation of Keensert inserts. A special drill fixture is utilized to assure proper location of the inserts.

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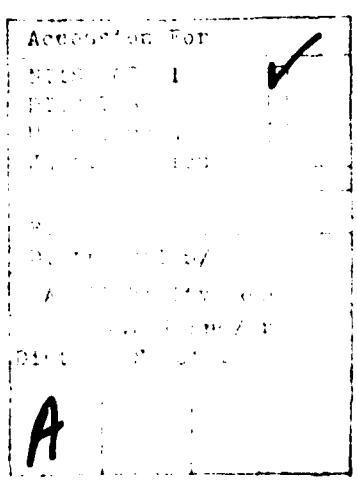

LIST OF FIGURES

I. INTRODUCTION

This report defines the procedure to be used in repairing damaged threads in the main wing mounting holes on IMPROVED HAWK training missiles. This procedure is valid for both types of IMPROVED HAWK training missiles:

- o MTM23B, Part No. 10690589, NSN 6920-00-106-4451
- o XM18E2, Part No. 11508526, NSN 6920-01-023-6138

On the MTM23B each wing is attached to the missile motor center ring by two 9/16-inch-diameter (in. dia) bolts for a total of eight 9/16-in. dia holes per missile. On the XM18E2 missiles, the wings are mounted differently, but the same eight holes are used for tying the missile down on the pallet and also for attaching the 45-degree lifting bar.

The threads in these holes are susceptible to damage due either to repeated use, cross-threaded bolts, or excessive torque. If the threads are badly damaged, it is unsafe to use the 45-degree lifting bar to lift the missile. Damaged threads can be repaired by installation of an insert, but it is necessary to use a special drill fixture to assure proper alignment of the holes. Section II of this report will define the procedure to be used in repairing damaged threads by installing inserts.

Inserts can be damaged in the same manner as can the original threads. Insert replacement is relatively easy, but proper tools and procedures are essential. Section III of this report defines the procedure to be used in replacing damaged inserts.

II. INSTALLATION OF INSERTS

A. Introduction

If one or more of the 9/16-18 wing attach holes on a HAWK training missile is damaged, it should be repaired by the installation of an insert. As a minimum, an insert should be installed in the damaged hole and in the adjacent hole at the same wing station. It is suggested that inserts be installed in all eight holes.

It is essential that the procedure be followed very closely to assure proper alignment of the inserts. As shown in the following procedure, the first step is to drill and tap two small holes for use in clamping the drill fixture firmly in place. The wing mounting holes are then drilled and tapped to fit the insert, and the insert is installed. Each step must be done carefully. Safety glasses should be worn during all operations.

This procedure requires a significant amount of drilling through steel. Sharp drill bits of the correct size are essential. Drill bits should be sharpened as needed. The work is somewhat arduous. If all tools and equipment are available and personnel are familiar with the procedure, installation of eight inserts will require about three hours of diligent work for one man. An assistant is desirable, but not essential.

B. Equipment Required for Insert Installation

Item No.	Item*	No. Req	Incl in Kit	Spares Req	Comments
1	Drill Fixture, Part No. 13060995	1	Yes	No	
2	Drill Fixture, 9/16 I.D., 1.00 O.D., 1.75 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-64-28-9/16 I.D., or equal	2	Yes	No	
3	Drill Bushing, ½ I.D., 1.00 O.D., 1.75 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-64-28-½ I.D., or equal	1	Yes	No	
4	Drill Bushing, 49/64 I.D. 1.00 O.D., 1.75 long, ANSI Slip Renewable Head, Carr Lane Part No.5-64-28-49/64 I.D., or equal	1	Yes	No	
5	Drill Bushing, 25/32 I.D., 1.00 O.D., 1.75 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-64-28-25/32 I.D., or equal	1	Yes	No	Tap Guide for 13/16-16 Tap
6	Drill Bushing, 17/64 I.D., 0.500 O.D., 2.125 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-32-34-17/64 I.D. or equal	1	Yes	No	
7	Drill Bushing, 5/16 I.D., 0.500 O.D., 2.125 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-32-34-5/16 O.D., or equal	2	Yes	No	
8	Drill Bushing, 21/64 I.D., 0.500 O.D., 2.125 long, ANSI Slip Renewable Head, Carr Lane Part No. 5-32-34-21/64 I.D., or equal	1	Yes	No	Tap Guide for 5/16-18 Tap
9	Keensert Installation Tool, Tridair Industries, Part No. THD918L	1	Yes	No	
10	Keensert Inserts, NAS1395C-9, or Tridair Industries, Part No. KNH-918	See Cmts	Yes	Yes	1 Insert Req per hole to be repaired; 8 per msl

*All dimensions in inches unless otherwise specified.

Item No.	Item	No. Req	Incl in Kit	Spares Req	Comments
11	Drill Bit, 17/64 dia, fluted portion to be a minimum of 3.75 in. long	1	Yes	Yes	Spares likely to be req due to breakage
12	Drill Bit, ½-in. dia, fluted portion to be a minimum of 4.00 in. long	1	Yes	Yes	Spares may be req due to breakage
13	Drill Bit, 49/64 dia, fluted portion to be 4.00 in. long minimum, ½ dia shank	1	Yes	No	
14	Tap, 5/16-18 UNC, long shank (pulley tap), 4.00 min length, starting tap	1	Yes	Yes	Spares likely to be req due to breakage
15	Tap, 9/16-18 UNF, starting	1	Yes	No	
16	Tap, 9/16-18 UNF, bottoming	1	Yes	No	
17	Tap, 13/16-16 UN, starting	1	Yes	No	
18	Tap Handle, T-type, to fit 5/16-18 Tap	1	Yes	No	
19	Tap Handle, Bar-type, to fit 9/16-18 and 13/16-16 Taps	1	Yes	No	
20	Bolt, 9/16-18 UNF, Steel, Socket Head, 2.850 in. long	2	Yes	Yes	Spares may be req due to thread damage
21	Bolt, 5/16-18 UNC, Steel, Socket Head, 2.850 in. long	2	Yes	Yes	
22	Washer, Flat, Steel, 9/16 I.D.	4	Yes	No	
23	Set Screw, 5/16-18 UNC, 0.500 long, Steel, CRES or Cadmium Plate, type of point optional	See Cmts	Yes	Yes	2 req per station repaired; 8 per msl
24	Vice Grip Pliers, 6 in.	1	Yes	No	
25	Magnet, Pencil Type, on 0.25-in.-dia shaft, approx 6 in. long	1	Yes	No	To remove chips from drilled holes

Item No.	Item	No. Req	Incl in Kit	Spares Req	Comments
26	Drift Punch, Steel, 0.125 dia tip	1	Yes	No	
27	Allen Wrench, ¼-in.	1	Yes	No	
28	Allen Wrench, 5/32-in.	1	Yes	No	
29	Allen Wrench, 7/16-in.	1	Yes	No	
30	Safety Glasses	1	Yes	No	
31	Zinc Chromate Primer, Liquid, per TT-P-1757, or equal	A.R.	Yes	Yes	
32	Cotton Swabs	A.R.	Yes	Yes	To apply zinc chromate primer to threads
33	File, 8-in. half-round, or equal	1	No	No	
34	Light Machine Oil	A.R.	Yes	Yes	
35	Hand Drill, ½-in. dia chuck capacity, electric or air	1	No	-	
36	Hand Drill, 3/8-in. dia chuck capacity, electric or air	1	No	-	Optional: ½-in. drill can be used; smaller drill is useful
37	Hand Nozzle for Compressed Air	1	No	1	Optional;very useful for removing chips
38	Compressed Air Supply for Hand Nozzle and Air Drill, if required	-	-	-	Optional
39	Electric supply for hand drills; 110-V, 60-cycle, or other as req	-	-	-	
40	Hammer, 12- to 24-oz, Ball-peen or Claw	1	No	No	
41	Paper Towels, Chem Wipes, or equal	A.R.	No	Yes	

C. Procedure

1. Inspect missile and select the holes to be repaired. It is recommended that inserts be installed in all eight holes.

2. Place missile in a convenient position for access to the first wing station to be worked on. A missile stand may be used, but the work is easier if the missile is placed directly on the floor. If the work is done outdoors, pieces of wood or other available material should be used to keep the missile out of the dirt or mud. Roll the missile into a convenient position. Preferably, the missile should be rotated until the wing station being repaired is at the top. Use wood or other available material to chock the missile firmly in position. Exercise caution to prevent the 1400-pound missile from rolling onto a foot or other part of the body.

3. Wipe off area around the wing attach holes using a cloth, paper towel, or similar material (Item 37). Clean out threaded holes as required to remove dirt, etc.

4. Run a 9/16-18 bottoming tap (Item 16) into each hole as far as it will go. Use a starting tap (Item 15) prior to using bottoming tap, if needed, to start tap into damaged threads.

5. Wipe off area around holes. It is important that the drill fixture fit flush on the curved surface of the missile center ring.

6. Insert 9/16-inch-I.D. drill bushings (Item 2) into both the large holes in the drill fixture. Wipe all foreign matter from the concave bottom surface of the drill fixture. Check fit of the drill fixture onto the missile. In some cases the edge of the fixture may contact the center ring cover of the missile and prevent the holes in the fixture from lining up with the missile holes. If this occurs, the missile cover should be filed or ground as required to clear the fixture. This will probably not be required. A half-round file (Item 33) can be used. If available, a small rotary grinder may be used.

7. Bolt drill fixture to missile using two 9/16-inch-diameter bolts (Item 20) through the drill bushings and into the holes in the missile, as shown in Figure 1. Tighten bolts with 7/16-inch Allen wrench (Item 29). Use sufficient torque on the bolts to firmly clamp the fixture to the missile. A good hard torque applied by hand using a standard length Allen wrench is adequate (approximately 120-inch-pounds). If a bolt is too long for the hole, it will bind against the bottom of the hole, and the fixture will not be clamped firmly to the missile surface. If this occurs, use one or two washers (Item 22) under the bolt head.

8. Insert the 17/64-inch I.D. drill bushing (Item 6) into one of the ½-inch-diameter holes in the drill fixture (see Figure 1).

9. Use the long fluted 17/64-inch-diameter drill bit (Item 11) to drill through the drill bushings into the steel missile center ring. The long flutes will aid in the flow of chips through the drill bushing. A standard length drill will quickly clog with steel chips. Use light oil as needed. The oil will cool the bit and aid in cutting, but may also cause chips to clog the drill bit. Remove the drill bit and clean out chips as required. Use compressed air, if available, to blow out chips. Wear safety glasses while blowint out chips and during all drilling operations. A magnet-tipped rod (Item 25), which can be inserted into the hole, is also useful in removing chips. The ½-inch drill (Item 35) can be used for this operation, but it is desirable to have a 3/8-inch lighter duty drill (Item 36). This will be easier to use,

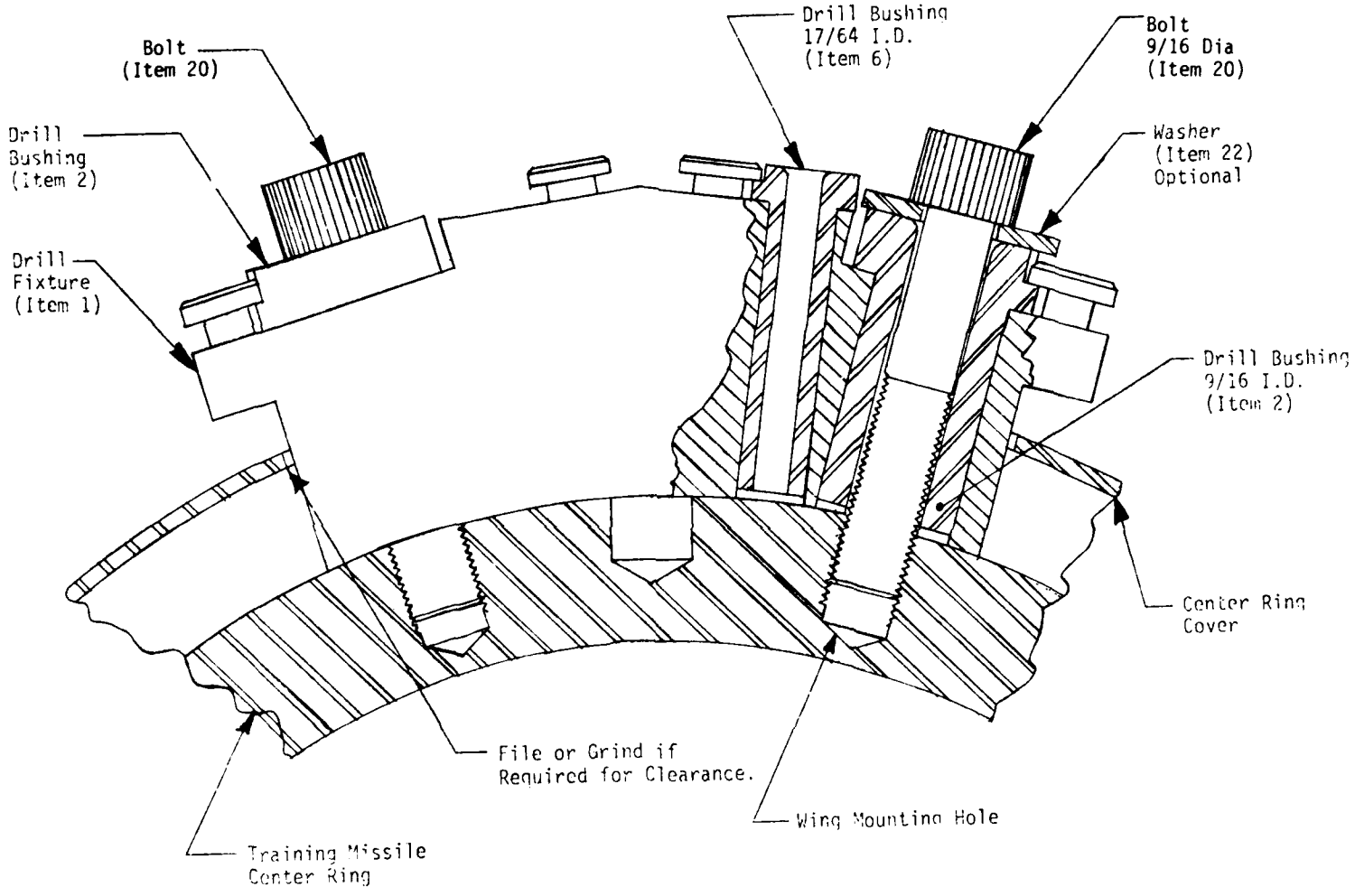

Figure 1. Keensert installation: Ready for drilling first hole.

minimize drill bit changing, and minimize drill bit breakage. Exercise care to avoid breaking the drill bit.

10. Drill a 17/64-inch-diameter hole through the wing ring, as shown in Figure 2.

11. Remove the 17/64-inch I.D. drill bushing and insert it into the other ½-inch hole in the drill fixture.

12. Insert the 25/32-inch I.D. tap guide drill bushing (Item 5) into the ½-inch hole in the drill fixture.

13. Use the T-type tap handle (Item 18) and insert the long shank 5/16-18 UNC (Item 14) tap through the tap guide drill bushing. Tap the hole to a depth of 0.50 inch minimum, as shown in Figure 2. Use care to avoid breaking the tap.

14. Remove the tap guide drill bushing and clean the threads. Use an air hose if it is available.

15. Insert a 5/16-inch I.D. drill bushing (Item 7) into the ½-inch hole in the drill fixture.

16. Insert a 5/16-inch-diameter bolt (Item 21) through the drill bushing and into the new threads. Tighten bolt with a ¼-inch Allen wrench (Item 27). Apply the maximum torque that is comfortable to the hand using the wrench.

17. Drill and tap a second 5/16-inch-diameter hole and install another 5/16-inch bolt through the other ½-inch hole in the drill fixture. Use the same drill bit, drill bushings, tap, tools, and procedures as in Steps 8 through 16.

18. Remove one of the 9/16-inch-diameter bolts and the 9/16-inch I.D. drill bushing. Leave the other 9/16-inch-diameter bolt in place. In a few cases there may be a helicoil insert in the 9/16-18 holes. If so, the insert should now be removed using the hammer, drift punch, and vice grip pliers.

19. Insert the ½-inch I.D. drill bushing (Item 3) into the 1-inch-diameter hole in the drill fixture and insert the 17/64-inch I.D. bushing (Item 6), as shown in Figure 3.

20. Use the 17/64-inch-diameter drill bit (Item 11) to drill through the missile center ring, as shown in Figure 3. Use vice grip pliers, as needed, to hold the 17/64-inch I.D. bushing and prevent it from rotating.

21. Remove the 17/64-inch I.D. drill bushing. Leave the ½-inch I.D. drill bushing in place.

22. Use a ½-inch-diameter capacity drill (Item 35) and a ½-inch-diameter drill bit (Item 12). Drill through the ½-inch I.D. bushing and enlarge the 17/64-inch-diameter hole to ½-inch diameter.

23. Remove the ½-inch I.D. bushing and insert the 49/64-inch I.D. bushing (Item 4).

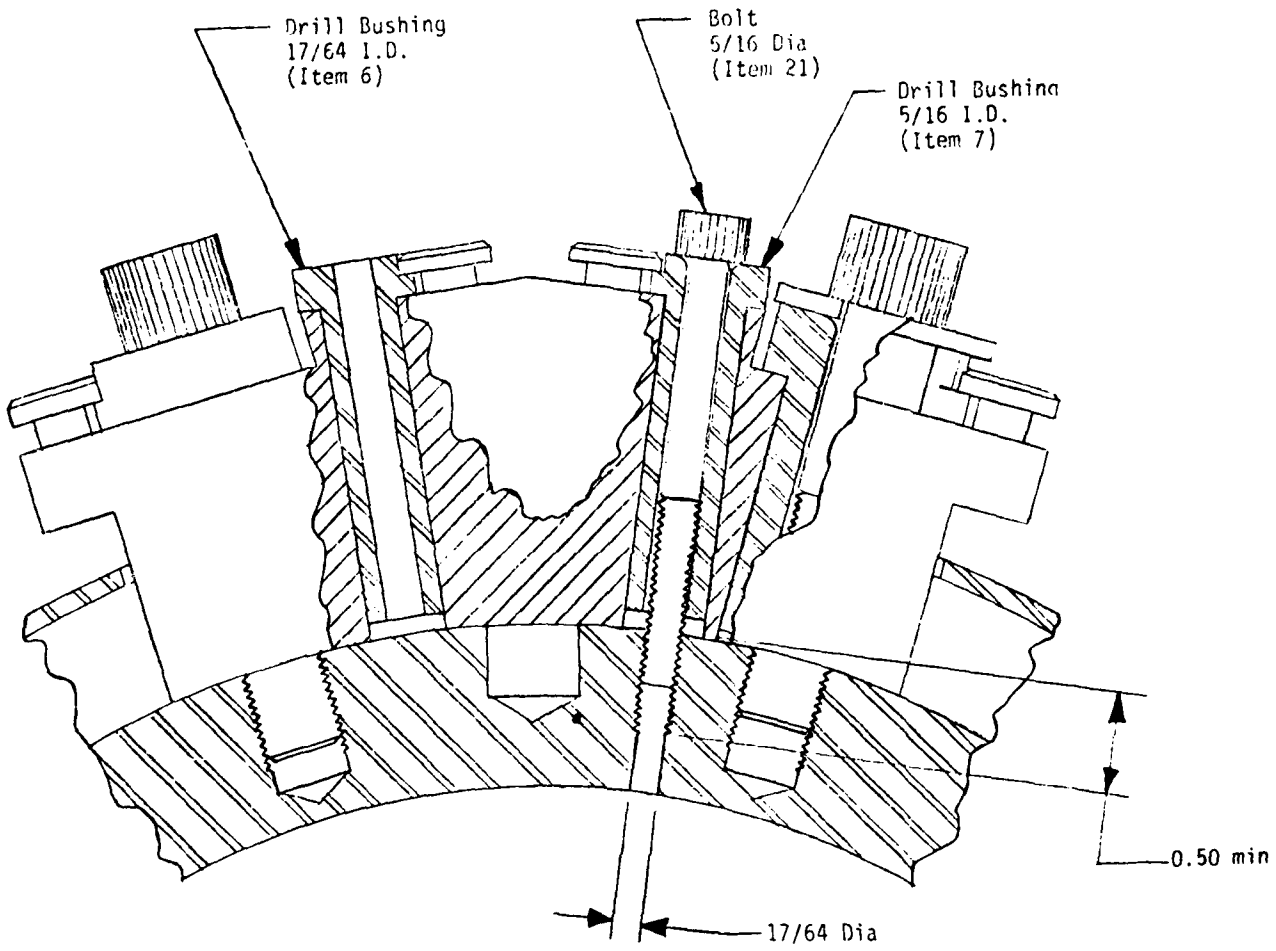

Figure 2. Keensert installation: One clamp bolt installed and ready to drill the second hole.

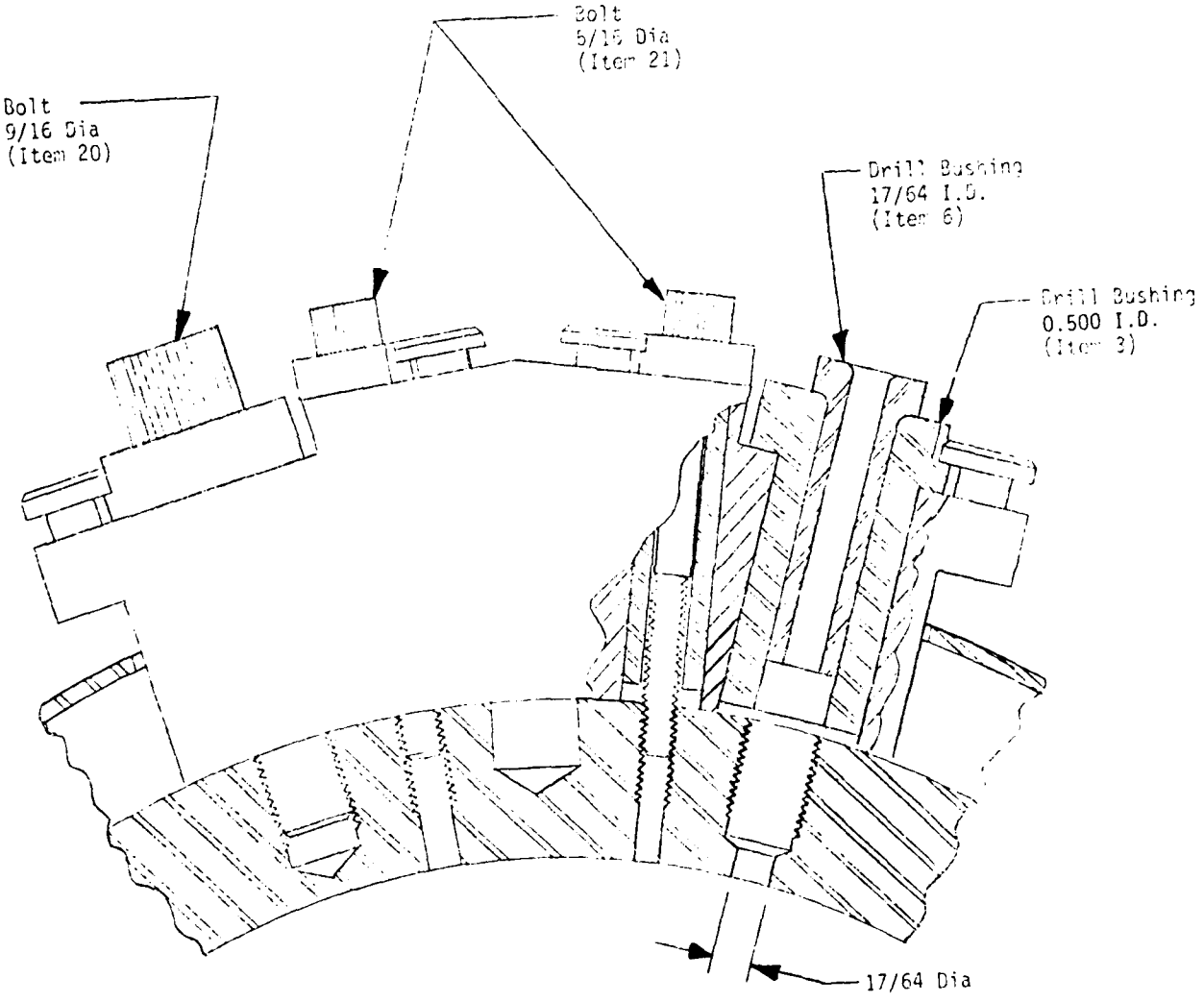

Figure 3. Keensert installation: Drill fixture in place with two bolts and pilot hole drilled in wing mounting hole.

24. Use the ½-inch-diameter capacity hand drill and the 49/64-inch-diameter drill bit (Item 13) and enlarge the ½-inch-diameter hole to 49/64-inch-diameter.

25. Remove the 49/64-inch I.D. bushing and install the 27/32-inch I.D. drill bushing (Item 5).

26. Use the 13/16-16 UN tap (Item 17) and tap handle (Item 19). Extend the tap through the drill bushing and tap completely through the missile center ring (see Figure 4).

27. Remove the three bolts holding the drill fixture and remove the fixture.

28. Take one of the inserts, Keensert Part No. KNH-918 (Item 10), and look at the internal thread. One one end of the insert there is a 0.10-inch-deep counterbore leading into the internal threads. Normally, this counterbore is on the same end of the Keensert as the four kees. When the insert is installed, the counterbore will be on the surface. This helps align the bolt and minimize cross threading. For this specific application, the counterbore is undesirable, because it reduces effective thread engagement of the wingbolt by about 1.5 threads. Because the wing bolt length is limited, it is desirable to have as much thread engagement as possible in order to protect the insert threads from being overstressed when the wing bolt is torqued.

29. If the kees are on the same end of the insert as the counterbore, the kees should be moved to the opposite end (see Figure 5).

30. Remove the kees by pulling straight out. It can be done easily by hand using a small pair of vice grip pliers (Item 24). A 9/16-18 bolt can be threaded into one end of the insert to serve as a handle.

31. Insert kees into the opposite end. The vee of the kee should be on the outside, as shown in Figure 5. A few kees may be lost or damaged. A minimum of three kees per insert should be retained. It is possible to cannibalize kees from other inserts, if necessary.

32. On one end of the Keensert installation tool (Item 9), there are four grooves on the outside of the cylindrical end piece. These grooves mate with the insert kees so that the tool can be used as a wrench. Use this end of the tool to thread the insert into the tapped hole to its full depth. This will assure that the threads are deep enough and that both the insert and missile threads are clean and undamaged. Clean and retap the threads as needed. The surface of the insert should be just below flush with the surface of the missile center ring. Retract the kees if necessary.

33. Remove the insert. Cover the insert external threads with a light coating of zinc chromate primer (Item 31) using a cotton swab (Item 32).

34. Use the Keensert installation tool and thread the insert into the tapped hole. The surface of the insert must be below flush with the missile center ring surface but not more than 0.03 inch below flush (see Figure 6).

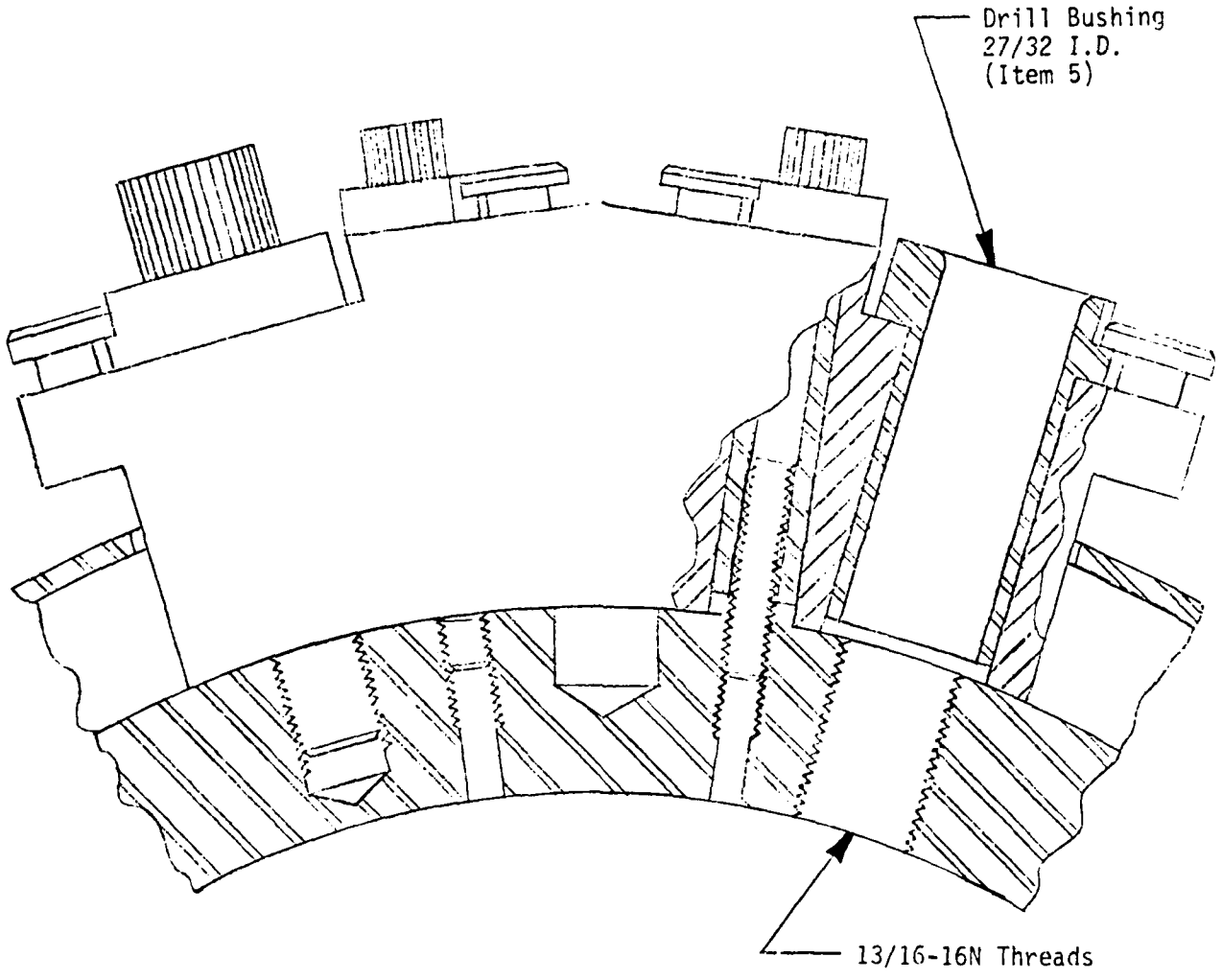

Figure 4. Keensert installation: First Keensert installation hole drilled and tapped.

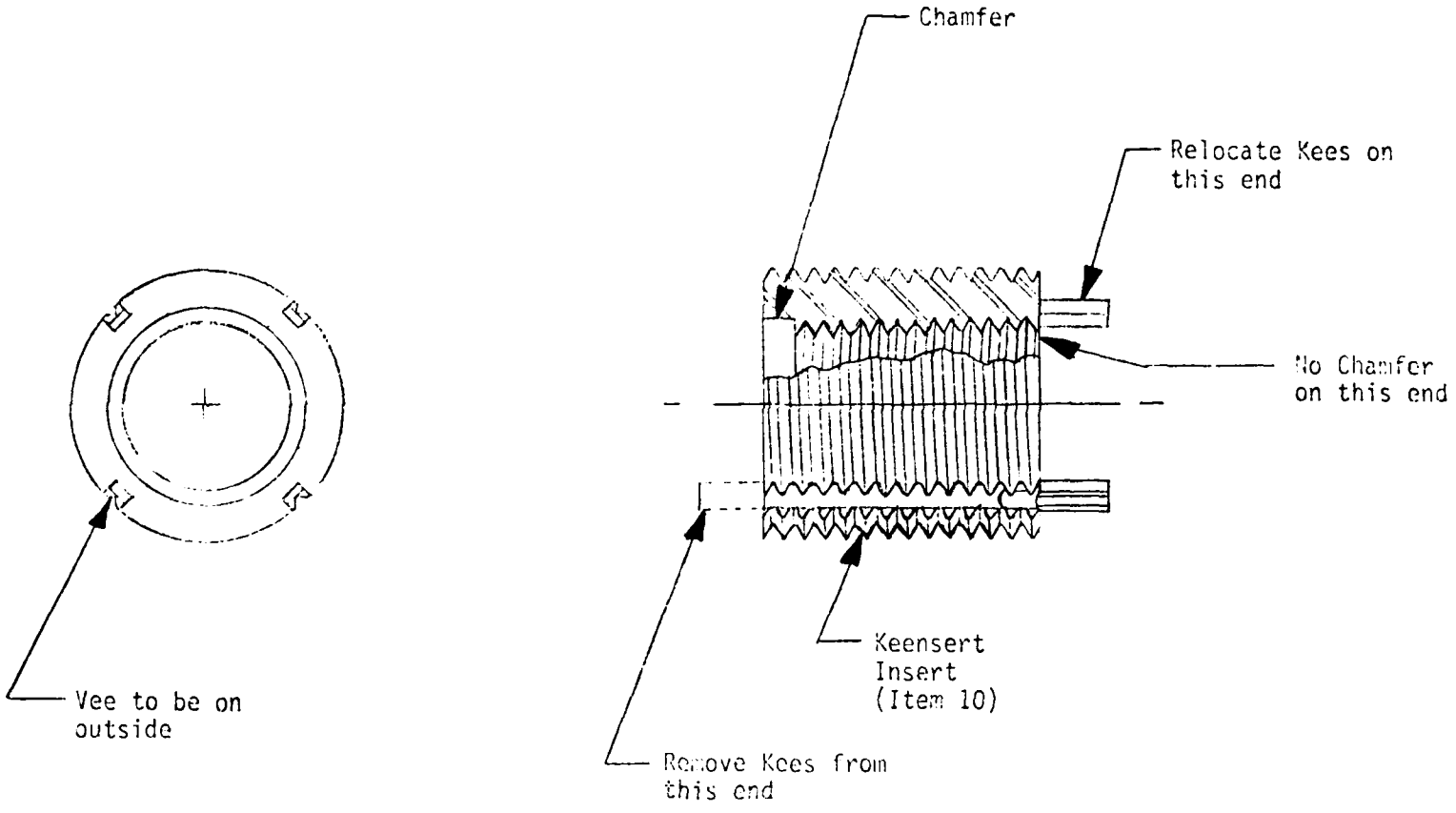

Figure 5. Keensert installation: Relocation of Keensert kees.

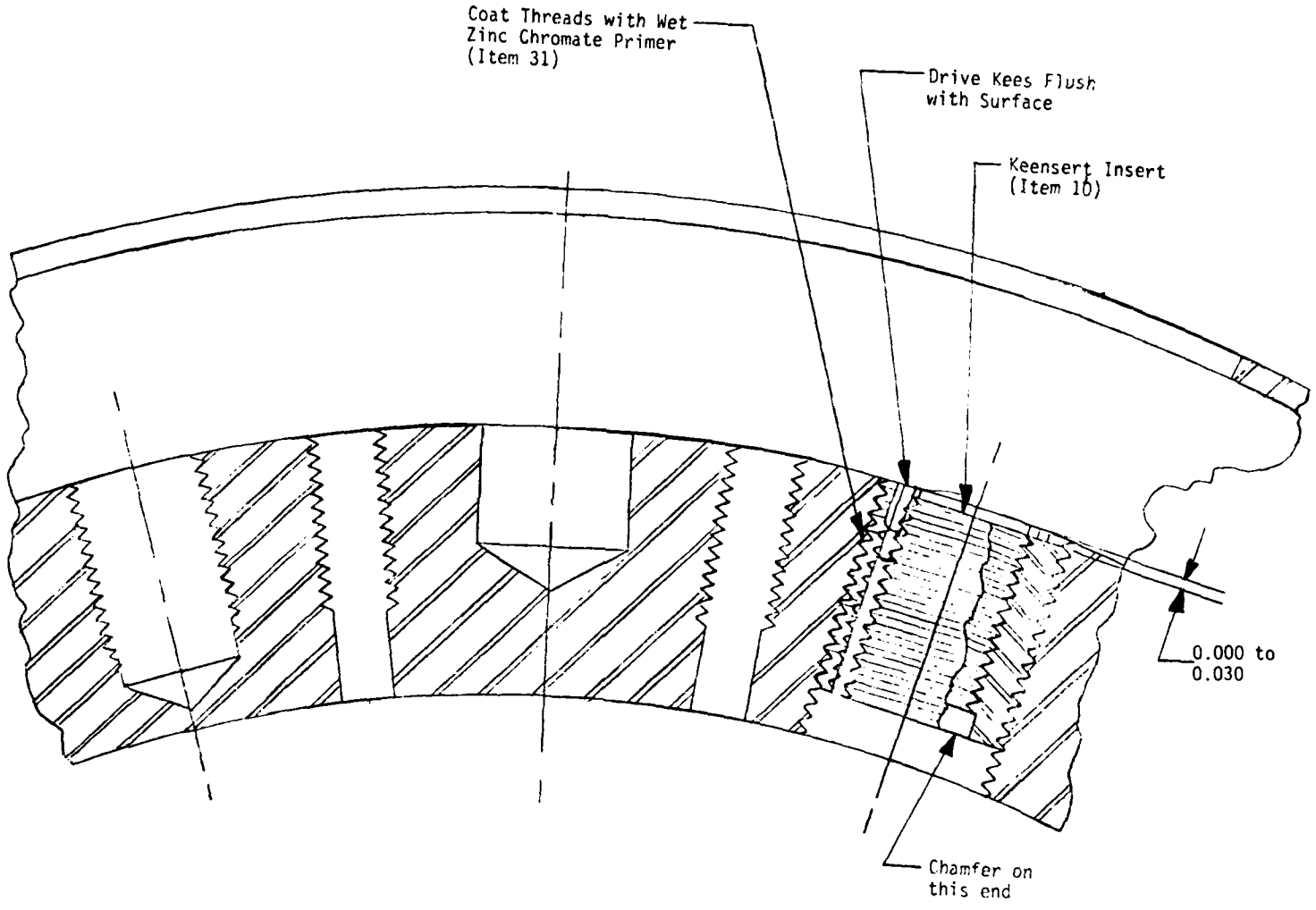

Figure 6. Keensert installation: First Keensert installed.

35. The other end of the tool (Item 9) has a spring-loaded sliding sleeve. Slide this sleeve over the kees and insert the small cylinder into the center of the insert.

36. Drive the kees down by beating on the exposed end of the tool with a hammer (Item 40). It is not necessary to use heavy blows. A series of light hammer blows will usually work better. If some of the kees start to bend, it may be possible to save them by carefully using the drift punch (Item 26) and hammer. Use the drift punch as needed after using the installation tool. Some kees may bend over and cannot be properly seated. Use the punch to drive down or break off any protruding kee segment. A minimum of two fully seated kees is required. It is desirable that all four kees be seated. If less than two kees are seated, the insert should be removed and another insert installed. See Part II of this procedure.

37. Reinstall the drill fixture on the missile, as shown in Figure 7, using two 5/16-inch bolts and one 9/16-inch bolt threaded into the Keensert. Use enough torque on the bolts to clamp the fixture securely in place.

38. Repeat Steps 8 through 36 for the remaining 9/16-inch-diameter hole.

39. Coat the threads of two 5/16-inch set screws (Item 23) with zinc chromate primaer (Item 31) and insert them into the two holes drilled and tapped earlier. The ends of the set screws should be flush to 0.030 inch below flush with the center ring surface (see Figure 8).

40. Test the finished installation by mounting a HAWK wing on the missile using the newly repaired holes. If the inserts are too high, the wing will not fit, and the insert will have to be removed and replaced.

41. If for any other reason the Keensерts will not fit a wing, the missile should be returned to Red River Army Depot for repair.

42. If the wing fits the inserts correctly, the repairs at this wing station are complete. The six holes at the other three wing stations should now be replaced using the same procedures.

III. REPLACEMENT OF INSERTS

A. Introduction

If one of the 9/16-18 wing attach holes on an IMPROVED HAWK training missile has a Keensert installed, and the threads on the Keensert are damaged, then the insert should be replaced.

The procedure which follows should be carefully adhered to. All Keenserts which show significant damage to the threads should be replaced. Do not replace Keenserts which do not show significant evidence of wear or damage.

A few holes may have been previously repaired using helicoil inserts. All helicoils should be replaced with Keenserts in accordance with the procedure presented in Section II of this report.

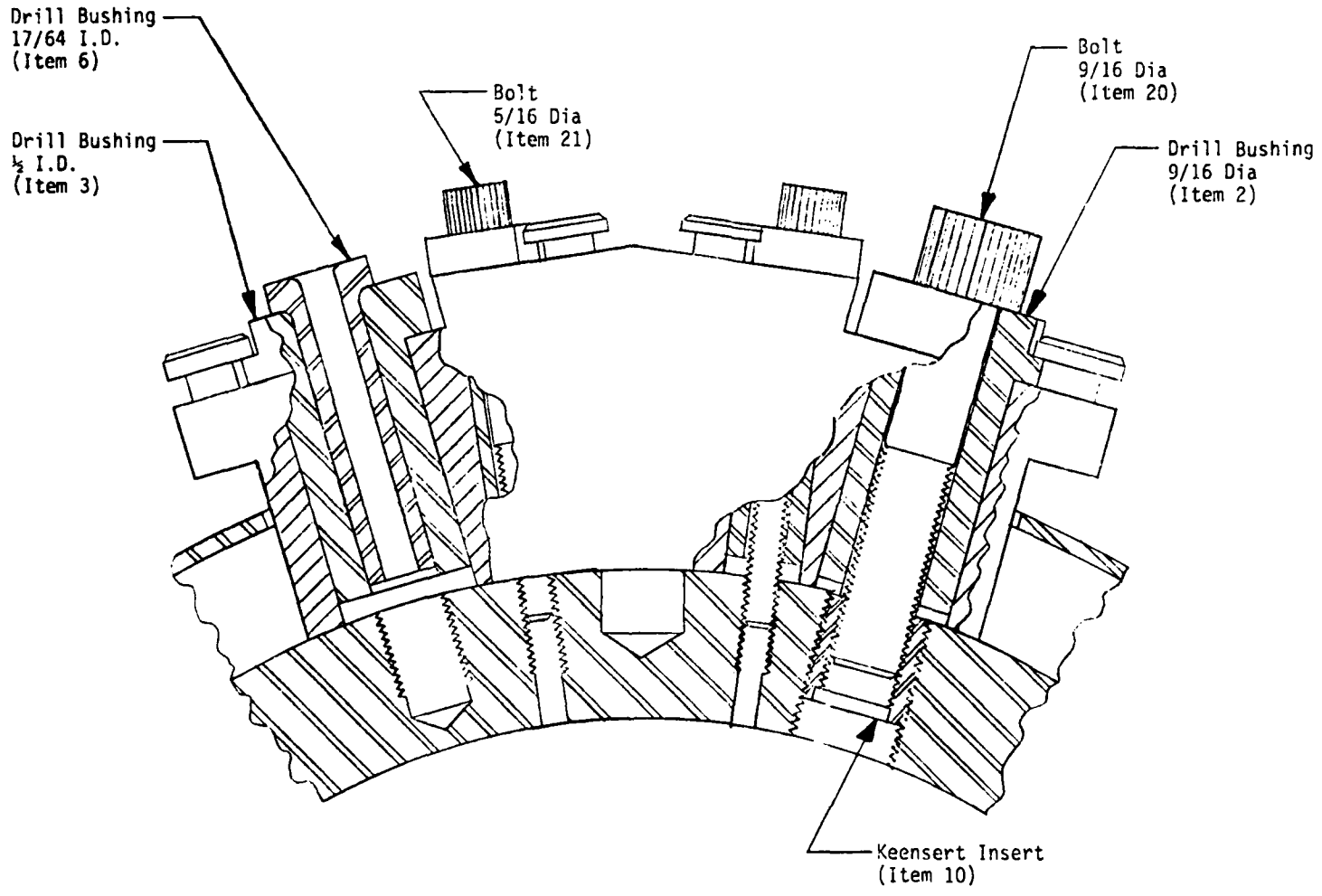

Figure 7. Keensert installation: First Keensert installed; ready to drill pilot hole for second Keensert.

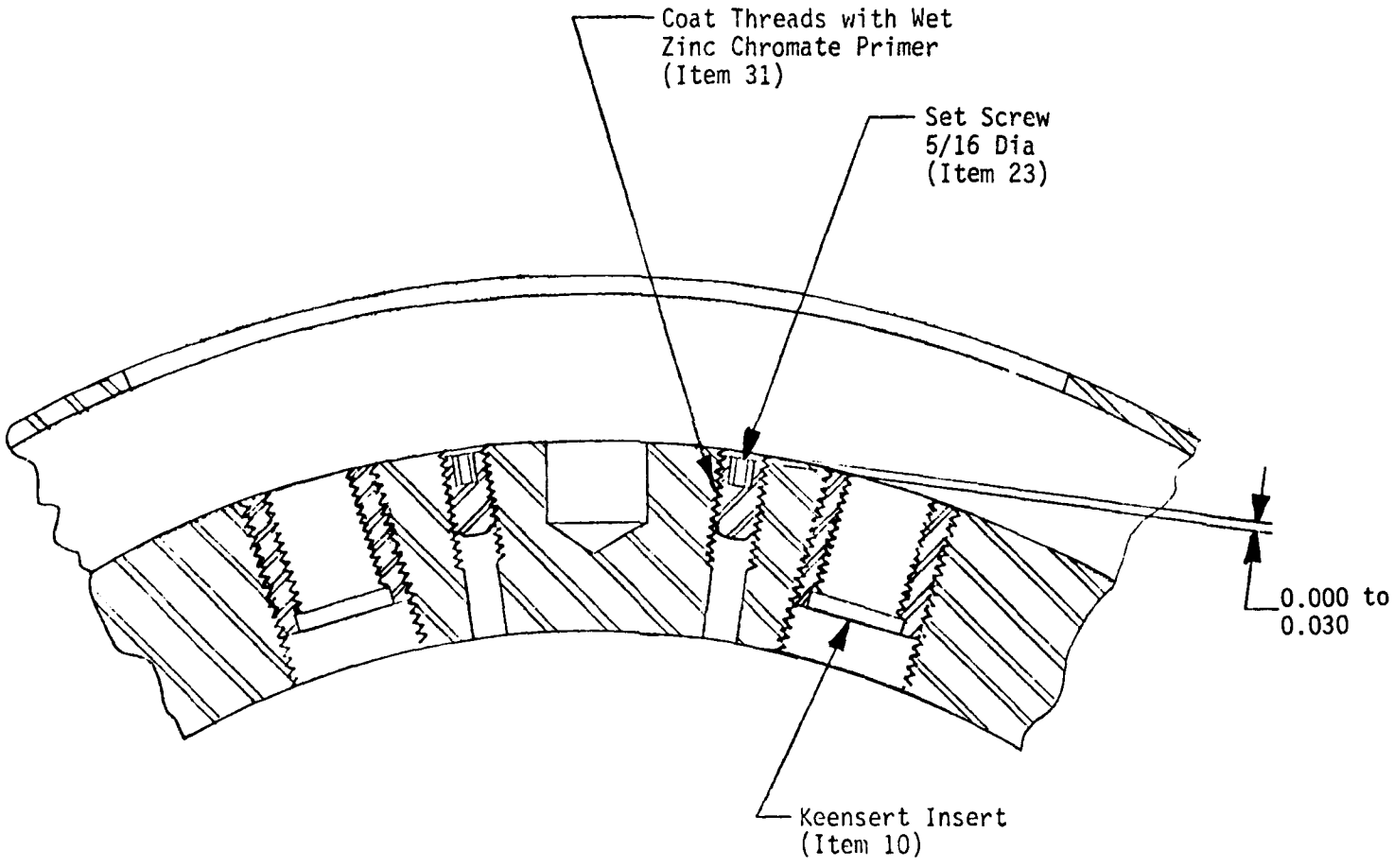

Figure 8. Keensert installation: Wing station after completion of Keensert installation.

B. Equipment Required for Insert Replacement

Item No.	Item	No. Req	Incl in Kit	Spares Req	Comments
42	Drill Bit, 23/32-in.-dia, ½-in. shank	1	Yes	No	
43	E-Z Out Tool, size to fit 23/32-in.-dia hole, Bendix Part No. EX-7 or equal	1	Yes	No	
44	8-in. Crescent Wrench or equal	1	No	No	To fit square drive on E-Z out
45	Drift Punch, 1/8-in.-dia shank	1	Yes	No	Item 26, Part I
46	Hand Drill, ½-inch chuck capacity, electric or air	1	No	No	Item 35, Part I
47	Keensert Insert, NAS1395C-9, or Tridair Industries PN KNH-918	A.R.	Yes	Yes	Item 10, Part I; 1 req per hole to be repaired
48	Keensert Installation Tool, Part No. THD918L	1	Yes	No	Item 9, Part I
49	Liquid Zinc Chromate Primer per TT-P-1757 or equal	A.R.	Yes	Yes	Item 31, Part I
50	Cotton Swabs to apply zinc chromate	A.R.	Yes	Yes	Item 32, Part I
51	Paper Towel, Chem Wipes, or equal	A.R.	No	Yes	Item 41, Part I
52	Electricity or Air Supply for drill, Item 46	-	-	-	Item 39, Part I
53	Vice Grip Pliers, 6-in.	1	Yes	No	Item 24, Part I
54	Hammer, 12- to 24-oz, Ball-peen or claw	1	No	No	Item 40, Part I
55	Tap, 13/16 UN	1	Yes	No	Item 17, Part I
56	Center Punch, 1/8-in.-dia shank, long sharp point	1	Yes	No	

C. Insert Replacement Procedure

1. Inspect missile and select inserts to be replaced. Any inserts which show significant damage should be replaced. Any holes without inserts which show significant damage and any holes with helicoil inserts should be repaired in accordance with the procedure given in Section II of this report.

2. Place the missile in a convenient position for access to the first wing station to be worked on. A missile stand may be used, but the work is easier if the missile is placed directly on the floor. If the work is done outdoors, pieces of wood or other available material should be used to keep the missile out of the dirt or mud. Roll the missile into a convenient position. The easiest method is to rotate the missile until the wing station being repaired is at the top. Use wood or other available material to chock the missile firmly in position. Exercise caution to prevent the 1400-pound missile from rolling onto a foot or other part of the body.

3. Wipe off area around the wing attach holes using a cloth, paper towel, or similar material. Wear safety glasses during all operations.

4. Use the hand drill and the 23/32-inch-diameter drill bit (Item 42) and drill a hole 3/16- to 1/4-inch deep into the center of the Keensert, as shown in Figure 9.

5. Use the center punch (Item 56) and a hammer to deflect the kees inward (Figure 10) and either break them off or pull them out with pliers.

6. Unscrew the insert using the E-Z out tool (Item 43) and crescent wrench (Item 44).

7. Take one of the inserts, Keensert Part No. KNH-918 (Item 47), and look at the internal thread. On one end of the insert there is a 0.10-inch-deep counterbore leading into the internal threads. Normally, this counterbore is on the same end of the Keensert as the four kees. When the insert is installed, the counterbore will be on the surface. This helps align the bolt and minimize cross threading. For this specific application, the counterbore is undesirable, because it reduces effective thread engagement of the wing bolt by about 1.5 threads. Because the wing bolt length is limited, it is desirable to have as much thread engagement as possible in order to protect the insert threads from being overstressed when the wing bolt is torqued.

8. If the kees are on the same end of the insert as the counterbore, the kees should be moved to the opposite end (see Figure 5).

9. Remove the kees by pulling straight out. It can be done easily by hand using a small pair of vice grip pliers (Item 53). A 9/16-18 bolt can be threaded into one end of the insert to serve as a handle.

10. Insert kees into the opposite end. The vee on the kee should be on the outside, as shown in Figure 5. A few kees may be lost or damaged. A minimum of three kees per insert should be retained. It is possible to cannibalize kees from other inserts, if necessary.

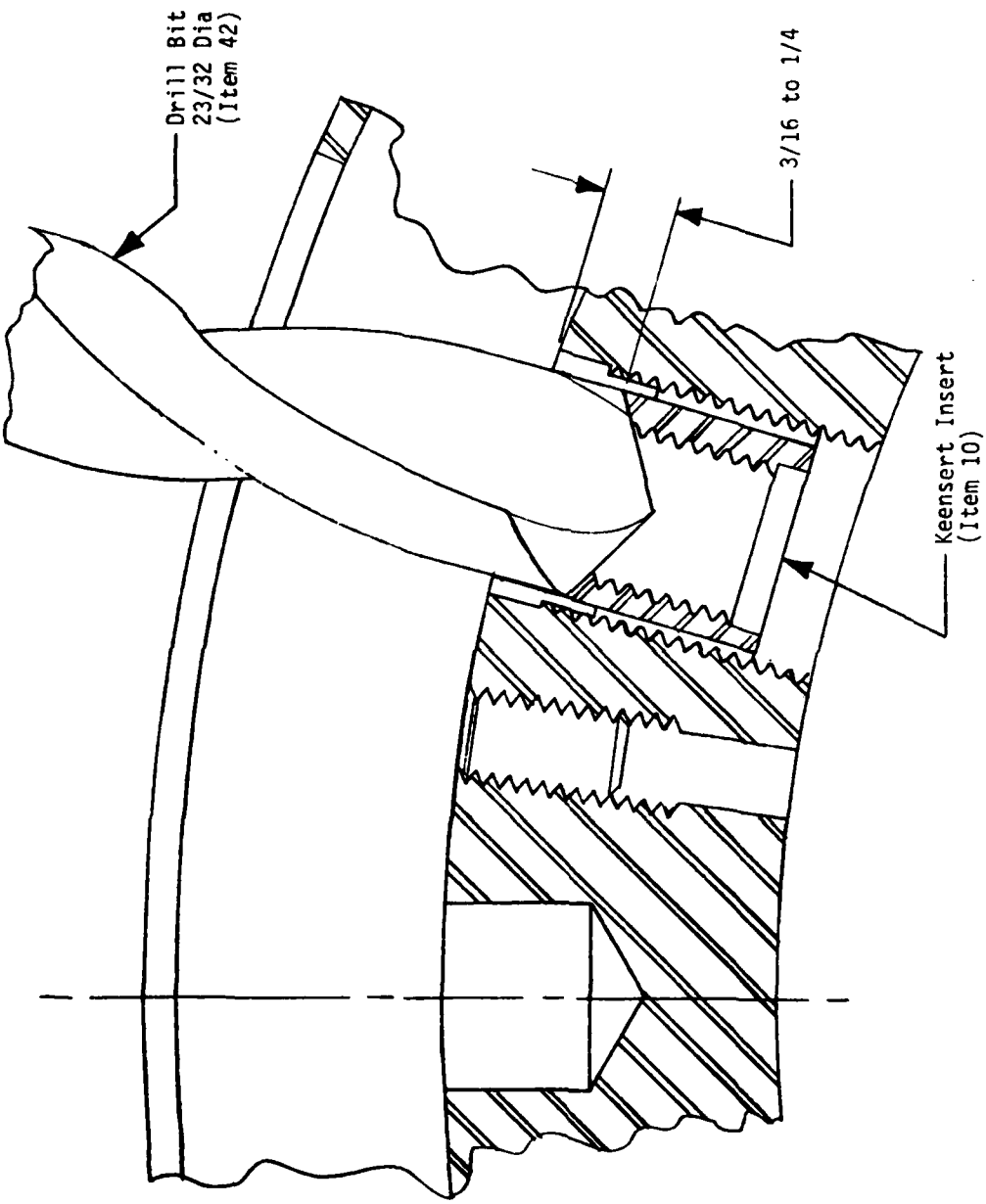

Figure 9. Keensert removal: Drill to base of kees.

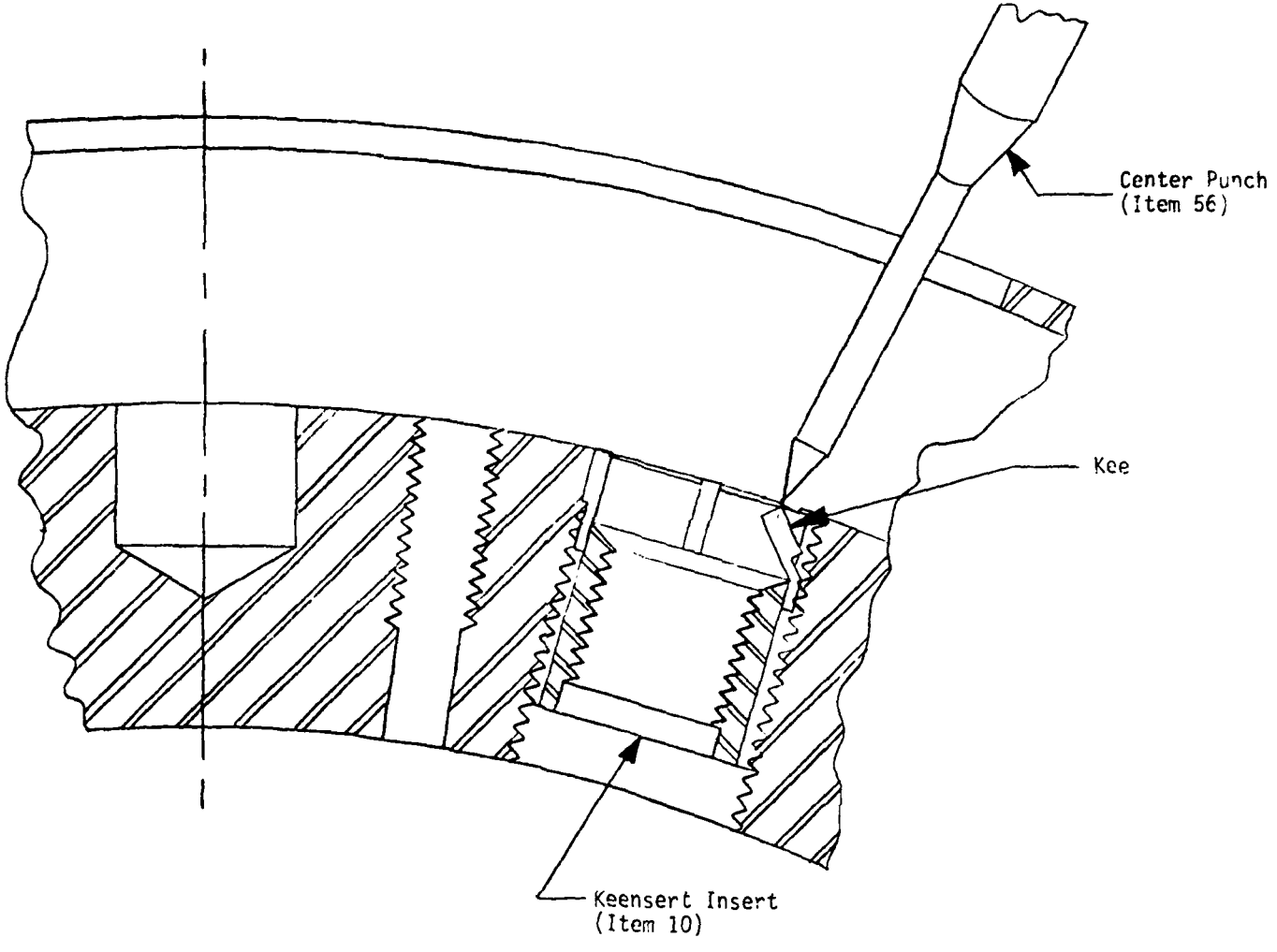

Figure 10. Keensert removal: Break off kees.

11. On one end of the Keensert installation tool (Item 48), there are four grooves on the outside of the cylindrical end piece. These grooves mate with the insert kees so that the tool can be used as a wrench. Use this end of the tool to thread the insert into the tapped hole to its full depth. This will assure that the threads are deep enough and that both the insert and missile threads are clean and undamaged. Clean and retap the threads as needed. Use the 13/16-16 tap (Item 55). The surface of the insert should be just below flush with the surface of the missile center ring. Retract the kees, if necessary.

12. Remove the insert. Cover the insert external threads with a light coating of zinc chromate primer (Item 49) using a cotton swab (Item 50).

13. Use the Keensert installation tool and thread the insert into the tapped hole. The surface of the insert must be below flush with the missile center ring surface, but not more than 0.03 inch below flush (see Figure 5). Align the kees with the kee groves from the previous insert, if possible.

14. The other end of the tool (Item 9) has a spring-loaded sliding sleeve. Slide this sleeve over the kees and insert the small cylinder into the center of the insert.

15. Drive the kees down by beating on the exposed end of the tool with a hammer (Item 54). It is not necessary to use heavy blows. A series of light hammer blows will usually work better. If some of the kees start to bend, it may be possible to save them by carefully using the drift punch (Item 45) and hammer. Use the drift punch as needed after using the installation tool. Some kees may bend over and cannot be properly seated. Use the punch either to drive down or break off any protruding kee segment. A minimum of two fully seated kees per insert is required. It is desirable that all four kees be seated. If less than two kees are seated, the insert should be removed and another insert installed.

16. Test the finished installation by mounting a HAWK wing on the missile using the newly repaired holes. If the inserts are above flush, the wing will not fit, and the insert will have to be removed and replaced.

17. If for any other reason the Keenserts will not fit a wing, the missile should be returned to Red River Army Depot for repair.

18. If the wing fits the inserts correctly, the repairs at this wing attach hole are complete. Replace inserts at the other holes as needed.

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